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IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application of William Stuchlik et al. Art Unit 1744
Reissue of Patent No. 6,493,896
Serial No. 10/684,324
Filed October 10, 2003
For BRUSH HEAD POSITIONING SYSTEM
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REVISED SUPPORT FOR CLAIM CHANGES

The amendments to claims 6, 7, 9, 11, 12, 14, 18, 19, 20, 21, 22 and 23 are supported by Figures 1 and 2 and the specification describing Figures 1 and 2. For example, the following footnotes identify the columns and lines of U.S. Patent No. 6,493,896 which support amendments to claims 6, 7, 9, 11, 12, 14, 18, 19, 20, 21, 22 and 23:

> 6. The apparatus of claim 5 wherein the support [is] comprises a [traveling] nut, wherein the actuator comprises a motor rotating a screw which engages and drives the [traveling] nut, said nut being raised and lowered by rotation of the screw, and wherein the connector assembly comprises:
> a slotted tube having a slot at one end receiving a pin sliding within the slot, the pin connected to the [traveling] nut, the tube supporting the head assembly at its other end; and
> a compressible member within the tube [having one end engaging the nut and having another end engaging the tube] between the support and the head assembly;[1] and
> wherein the sensor comprises a linear sensor detecting a length of the compressible member.
>
> 7. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:
> a vehicle adapted to ride on the surface;
> a head assembly on the vehicle adapted to carry a device for engaging and treating the surface;
> a support on the vehicle connected to the head assembly;[2]

[1] 2/37, 42-43; 15/42-43; 15/50, 17/12-15; 17/46-47
[2] 2/35; 4/63; 10/1; 12/13

an actuator on the vehicle [supporting the head assembly over the surface and] adapted to raise and lower the [head assembly relative to the surface] support;

a sensor detecting a position of the head assembly relative to the [surface] support;

a [head] position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the [surface] support; and

a driving circuit responsive to the [head] position control and responsive to the sensor for energizing the actuator to raise and lower the [head assembly] support so that the position of the head assembly relative to the [surface] support as detected by the sensor corresponds to the desired position as indicated by the [head] position control thereby controlling the relative engagement between the head assembly and the surface independent of the brush length or stiffness and thereby controlling the treatment of the surface by the head assembly.

9. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly on the vehicle adapted to carry a device for engaging and treating the surface;

a support on the vehicle connected to the head assembly;[3]

an actuator on the vehicle [supporting the head assembly over the surface and] adapted to raise and lower the [head assembly relative to the surface] support;

a sensor detecting a position of the head assembly relative to the [surface] support;

a [head] position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the [surface] support; and

a driving circuit responsive to the [head] position control and responsive to the sensor for energizing the actuator to raise and lower the [head assembly] support so that the position of the head assembly relative to the [surface] support as detected by the sensor corresponds to the desired position as indicated by the [head] position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

[a support connected to the actuator and being raised and lowered by the actuator; and

a connector assembly including a compressible member between the support and the head assembly;]

[3] 2/35; 4/63; 10/1; 12/13

wherein the sensor comprises a distance sensor connected between the support and the head assembly for detecting a distance between the support and the head assembly[; and

wherein the driving circuit responds to the distance sensor to control the head position of the head assembly relative to the surface to maintain contact between the head assembly and the surface].

11. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly on the vehicle adapted to carry a device for engaging and treating the surface;

a support on the vehicle connected to the head assembly;[4]

an actuator on the vehicle [supporting the head assembly over the surface and] adapted to raise and lower the [head assembly relative to the surface] support;

a sensor detecting a position of the head assembly relative to the [surface] support;

a [head] position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the [surface] support;

a driving circuit responsive to the [head] position control and responsive to the sensor for energizing the actuator to raise and lower the [head assembly] support so that the position of the head assembly relative to the [surface] support as detected by the sensor corresponds to the desired position as indicated by the [head] position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

[a support adapted to be raised and lowered by the actuator;] and

a compressible member of variable length between the support and the head assembly;

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

12. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly on the vehicle adapted to carry a device for engaging and treating the surface;

a support on the vehicle connected to the head assembly;[5]

[4] 2/35; 4/63; 10/1; 12/13

[5] 2/35; 4/63; 10/1; 12/13

an actuator on the vehicle [supporting the head assembly over the surface and] adapted to raise and lower the [head assembly relative to the surface] support wherein the actuator comprises a motor rotating a screw in threaded engagement with [driving] a [traveling] nut [engaging the screw] of the support, said [nut] support being raised and lowered by rotation of the screw;

a sensor detecting a position of the head assembly relative to the [surface] support;

a [head] position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the [surface] support;

a driving circuit responsive to the [head] position control and responsive to the sensor for energizing the actuator to raise and lower the [head assembly] support so that the position of the head assembly relative to the [surface] support as detected by the sensor corresponds to the desired position as indicated by the [head] position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

a slotted tube having a slot at one end receiving a pin sliding within the slot, the pin connected to the [traveling] nut, the tube supporting the head assembly at its other end; and

a compressible member within the tube [having one end engaging the nut and having another end engaging the tube] between the support and the head assembly;[6]

wherein the sensor comprises a linear sensor detecting a length of the compressible member.

14. The apparatus of claim 12 wherein the sensor comprises a switch on the tube for detecting compression of the compressible member [wherein the repeatable position corresponds to the position of the device] when [it] the head assembly engages the surface.

18. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly on the vehicle adapted to carry a device for engaging and treating the surface;

a support on the vehicle connected to the head assembly;[7]

an actuator on the vehicle [supporting the head assembly over the surface and] adapted to raise and lower the [head assembly relative to the surface] support;

[6] 2/37, 42-43; 15/42-43; 15/50; 17/12-15; 17/46-47

[7] 2/35; 4/63; 10/1; 12/13

a sensor comprising a switch on the actuator for[8] detecting a position of the head assembly relative to the [surface] support;

a [head] position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the [surface] support; and

a driving circuit responsive to the [head] position control and responsive to the sensor for energizing the actuator to raise and lower the [head assembly] support so that the position of the head assembly relative to the [surface] support as detected by the sensor corresponds to the desired position as indicated by the [head] position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly[;

wherein the sensor comprises a switch on the actuator for detecting a position of the head assembly].

19. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a head assembly adapted to carry a device for engaging the surface;

a support connected to the head assembly;[9]

an actuator raising and lowering the [head assembly relative to the surface] support;

a position control responsive to operator input for indicating a head position of the [device] head assembly relative to the [surface] support or range of head positions of the [device] head assembly relative to the [surface] support, said head position or said range of head positions indicating a distance or range of distances, respectively, between the [device] head assembly and the [surface] support; and

a controller responsive to the position control for selectively actuating the actuator to maintain the [device] head assembly in the head position or within the range of head positions as indicated by the position control independent of the brush length or stiffness.

20. The apparatus of claim 19 further comprising:

a pressure sensor detecting the pressure of [device] the head assembly on the surface;

a pressure control responsive to operator input for indicating a desired pressure or a desired range of pressures for the [device] head assembly on the surface; and

wherein the controller is responsive to the pressure control and the pressure sensor for selectively actuating

[8] 19/9-33

[9] 2/35; 4/63; 10/1; 12/13

the actuator to maintain the pressure of the device on the surface at the desired pressure or within the desired range of pressures.

21. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a head assembly adapted to carry a device for engaging the surface;

a support connected to the head assembly;[10]

an actuator raising and lowering the [head assembly relative to the surface] support;

a position control responsive to operator input for indicating a [head] desired position of the [device] head assembly relative to the [surface] support or range of [head] desired positions of the [device] head assembly relative to the [surface] support, said [head] desired position or said range of [head] desired positions indicating a distance or range of distances, respectively, between the [device] head assembly and the [surface] support;

a controller responsive to the position control for selectively actuating the actuator to maintain the [device] head assembly in the [head] desired position or within the range of [head] desired positions as indicated by the position control;

a motor on the head assembly for rotating the device;

a torque control circuit having an input receiving a signal for controlling the torque of the motor; and

a torque control responsive to operator input for indicating a desired torque or a desired range of torques for the motor;

wherein the controller is responsive to the torque control for providing a torque control signal to the input of the torque control circuit to maintain the motor at the desired torque or within the desired range of torques.

22. The apparatus of claim 21 further comprising:

a pressure sensor detecting the pressure of [device] the head assembly on the surface;

a pressure control responsive to operator input for indicating a desired pressure or a desired range of pressures for the [device] head assembly on the surface; and

wherein the controller is responsive to the pressure control and the pressure sensor for selectively actuating the actuator to maintain the pressure of the device on the surface at the desired pressure or within the desired range of pressures.

[10] 2/35; 4/63; 10/1; 12/13

23. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a head assembly adapted to carry a device for engaging the surface;

a support connected to the head assembly;[11]

an actuator raising and lowering the [head assembly relative to the surface] support;

a position control responsive to operator input for indicating a repeatable [head] position of the [device] head assembly relative to the [surface] support or a repeatable range of [head] positions of the [device] head assembly relative to the [surface] support, said repeatable [head] position or said repeatable range of [head] positions indicating a distance or range of distances, respectively, between the [device] head assembly and the [surface] support; and

a controller responsive to the position control for selectively actuating the actuator to maintain the device in the repeatable [head] position or within the repeatable range of [head] positions as indicated by the position control independent of the brush length or stiffness.

The amendments to claims 15 and 17 are supported by Figures 3-8 and the specification describing Figures 3-8. For example, the following footnotes identify the columns and lines of U.S. Patent No. 6,493,896 which support amendments to claims 15 and 17:

15. An apparatus for use on a surface and responsive to an operator, said apparatus comprising:

a vehicle adapted to ride on the surface;

a head assembly on the vehicle adapted to carry a device for engaging and treating the surface;

a [head] position control, responsive to input from the operator, indicating a desired position of the head assembly relative to the [surface] support;

a driving circuit responsive to the [head] position control and responsive to the [sensor] detector for energizing the actuator to raise and lower the [head assembly] support so that the position of the head assembly relative to the [surface] actuator as detected by the [sensor] detector corresponds to the desired position as indicated by the [head] position control thereby controlling the relative engagement between the head assembly and the surface and thereby controlling the treatment of the surface by the head assembly;

wherein the actuator comprises a motor rotating a screw in threaded engagement with[14] [driving] a [traveling] nut [engaging the screw] of the support, said [nut] support being raised and lowered by rotation of the screw;

[wherein the sensor comprises a detector for providing a count corresponding to the position of the head;]

wherein the [head] position control is set by the operator to indicate [the] an additional preset amount the support is to be lowered below a repeatable position;[15] and

a comparator for comparing the count to the additional preset amount, said driving circuit being responsive to comparator to lower the [traveling nut] support below [a] the repeatable position [when the count corresponds to a position which is higher than] the additional preset amount as indicated by the [head] position control.

17. The apparatus of claim 16 further comprising a switch for detecting when the [nut] support is in the repeatable position, and wherein the switch resets the counter and wherein the driving circuit is responsive to the comparator to lower the [traveling nut] support a number of counts corresponding to the additional preset amount.

[14] 9/58
[15] 9/9-10, 34-35; 11/7-8, 18-19, 22-23; 18/25

Added claims 24, 25, 28, 31, 34, 35 and 38 are supported by Figures 1-8 and the specification describing Figures 1-8. For example, the following footnotes identify the columns and lines of U.S. Patent No. 6,493,896 which support added claims 24, 25, 28, 31, 34, 35 and 38:

> 24.[16] Apparatus for use by an operator on a surface comprising:
> a vehicle adapted to move across the surface;
> a head assembly on the vehicle for treating the surface;
> a support on the vehicle connected to the head assembly;
> an actuator on the vehicle for raising and lowering the support and the head assembly;
> a resiliently compressible member interposed between the support and the head assembly;
> a sensor for sensing a repeatable position of the support; and
> a control responsive to user input and the sensor for controlling the actuator to drive the support downward from said repeatable position an additional distance corresponding to said user input to compress said compressible member.
>
> 25.[17] The apparatus of claim 24 wherein said repeatable position of the support corresponds to a position in which the head assembly is in contact with the surface.
>
> 28.[18] Apparatus for use by an operator on a surface comprising:
> a vehicle adapted to move across the surface;
> a head assembly on the vehicle for treating the surface;
> a support on the vehicle connected to the head assembly;
> an actuator on the vehicle for raising and lowering the support and the head assembly;
> a resiliently compressible member interposed between the support and the head assembly;
> a sensor for sensing when the head assembly is lowered to a position corresponding to contact of the head assembly with the surface, and for generating a signal in response thereto; and

[16] 15/31-55; 19/34-51; 20/41-60
[17] 18/22-27
[18] 17/52-18/18

a control responsive to user input and the sensor for controlling the actuator to drive the support down to lower the head assembly until said signal is received and thereafter to drive the support down an additional distance to compress the compressible member an amount corresponding to said user input.

31.[19] Apparatus for use by an operator on a surface comprising:

a vehicle adapted to move across the surface;

a head assembly on the vehicle for treating the surface;

a support connected to the head assembly;

an actuator on the vehicle comprising a screw in threaded engagement with the support, and a motor for rotating the screw to raise and lower the support and the head assembly connected thereto;

a spring co-axial with the screw interposed between the support and the head assembly; and

a control responsive to user input for controlling the actuator to lower the support until the head assembly is in contact with the surface and the spring is compressed a preset amount corresponding to the user input.

34.[20] The apparatus of claim 31 wherein the support comprises a nut and wherein the actuator comprises a screw in threaded engagement with the nut and a motor for rotating the screw to raise and lower the nut, said apparatus further comprising a connector assembly connecting the head assembly and the support.

35.[21] The apparatus of claim 34 wherein the connector assembly comprises an outer tube containing said spring and connected to the head assembly, said support further comprising an inner tube secured to the nut and slidable inside the outer tube, and a pin connected to the inner tube slidable in a slot in the outer tube.

38.[22] The apparatus of claim 37 wherein the detector comprises a magnet adapted to rotate in synchronism with the screw, a Hall sensor detecting rotation of the magnet and providing a pulse, and a counter for counting the pulses of the Hall sensor, the comparator being operable to compare the count of the counter to the preset amount.

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[19] 17/52-18/18; 17/22-51; 19/34-51
[20] 19/9-23; 17/52-18/18
[21] 17/52-18/18
[22] 18/64-19/2

Added claims 26, 29, 32 and 37 are supported by Figures 3-8 and the specification describing Figures 3-8. For example, the following footnotes identify the columns and lines of U.S. Patent No. 6,493,896 which support added claims 26, 29, 32 and 37:

> 26.[23] The apparatus of claim 25 wherein the sensor comprises a switch on the vehicle for sensing when the support is lowered to said repeatable position, and wherein the control is responsive to the switch for controlling the actuator to drive the support downward from said repeatable position the additional distance to compress the compressible member.
>
> 29.[24] The apparatus of claim 28 wherein the sensor comprises a switch on the vehicle for sensing when the support is lowered to a position corresponding to contact of the head assembly with the surface and for generating a signal in response thereto, and wherein the control is responsive to the switch for controlling the actuator to drive the support down the additional distance to compress the compressible member.
>
> 32.[25] The apparatus of claim 31 further comprising a switch on the vehicle for sensing when the head assembly is in contact with the surface, and wherein the control is responsive to the switch for controlling the actuator to lower the support and compress the spring the preset amount.
>
> 37.[26] The apparatus of claim 31 wherein the support comprises a nut and wherein the actuator comprises a screw in threaded engagement with the nut and a motor for rotating the screw to raise and lower the nut, said apparatus further comprising:
>
> a detector for providing a count corresponding to the position of the support relative to the actuator;
>
> a position control set by an operator to indicate a preset amount; and
>
> a comparator for comparing the count to the preset amount, said control being responsive to the comparator to lower the support the preset amount below a position at which the head assembly is in contact with the surface.

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[23] 15/65-16/4; 18/23-27; 19/3-8; 19/9-33
[24] 15/65-16/4; 18/23-27; 19/3-8; 19/9-33
[25] 15/65-16/4; 18/23-27; 19/3-8; 19/9-33
[26] 15/57-64; 18/27-67; 19/3-8

Added claims 27, 30, 33 and 36 are supported by Figures 1 and 2 and the specification describing Figures 1 and 2. For example, the following footnotes identify the columns and lines of U.S. Patent No. 6,493,896 which support added claims 27, 30, 33 and 36:

> 27.[27] The apparatus of claim 25 wherein the sensor comprises a linear potentiometer between the head assembly and the support for sensing when the support is lowered to the repeatable position, and wherein the control is responsive to the linear potentiometer for controlling the actuator to drive the support downward from said repeatable position the additional distance to compress the compressible member.
>
> 30.[28] The apparatus of claim 28 wherein the sensor comprises a linear potentiometer between the head assembly and the support for sensing when the support is lowered to a position corresponding to contact of the head assembly with the surface and for generating a signal in response thereto, and wherein the control is responsive to the linear potentiometer for controlling the actuator to drive the support down the additional distance to compress the compressible member.
>
> 33.[29] The apparatus of claim 31 further comprising a linear potentiometer between the head assembly and the support for sensing a length of the spring, and wherein the control is responsive to the linear potentiometer for controlling the actuator to lower the support and compress the spring the preset amount.

[27] 15/56-64; 17/21-22
[28] 15/56-64; 17/21-22
[29] 15/56-64; 17/21-22

36.[30] The apparatus of claim 34 further comprising a linear sensor for detecting a length of the spring, the control being responsive to the linear sensor to operate the actuator to raise and lower the support.

Respectfully submitted,

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[30] 16/9-23; 17/23-18/18